What is claimed is:

1. A heat-resistant, high-toughness aluminum alloy comprising not less than 10 mass % and not more than 16 mass % of silicon, not less than 1 mass % and not more than 3 mass % of iron, not less than 1 mass % and not more than 2 mass % of nickel, not less than 0.5 mass % and not more than 2 mass % in total of one or more selected from the group consisting of titanium, zirconium, chromium and vanadium, not less than 0.6 mass % and not more than 3 mass % of copper, and not less than 0.2 mass % and not more than 2 mass % of magnesium, the balance being essentially aluminum, said alloy being obtained by densifying aluminum alloy powder prepared by gas atomizing, said silicon having an average grain diameter of not more than 4 μm.

2. The heat-resistant, high-toughness aluminum alloy of claim 1 which contains titanium by not less than 0.5 mass % and not more than 2 mass %.

3. The heat-resistant, high-toughness aluminum alloy of claim 1 or 2 having a density of 2.8 Mg/m^3 or less.

4. An engine part manufactured by subjecting the heat-resistant, high-toughness aluminum alloy of any of claims 1 to 3 to hot plastic working.

5. The engine part of claim 4 which is a piston.

6. A method of manufacturing a heat-resistant, high-toughness

aluminum alloy comprising:

preparing aluminum alloy powder by gas atomizing, said aluminum alloy powder comprising not less than 10 mass % and not more than 16 mass % of silicon, not less than 1 mass % and not more than 3 mass % of iron, not less than 1 mass % and not more than 2 mass % of nickel, not less than 0.5 mass % and not more than 2 mass % in total of one or more selected from the group consisting of titanium, zirconium, chromium and vanadium, not less than 0.6 mass % and not more than 3 mass % of copper, and not less than 0.2 mass % and not more than 2 mass % of magnesium, the balance being essentially aluminum;

subjecting said aluminum alloy powder to cold forming to obtain a preform;

heating said preform to a temperature range of not less than 400 degrees C and not more than 510 degrees C and holding said preform in said temperature range for 5 hours or less; and

subjecting said preform to hot plastic working to densify said preform, thereby obtaining a dense body as said heat-resistant, high-toughness aluminum alloy;

the silicon in said aluminum alloy having an average grain diameter of 4μm or less.

7. A method of manufacturing a heat-resistant, high-toughness aluminum alloy comprising:

preparing aluminum alloy powder by gas atomizing, said aluminum alloy powder comprising not less than 10 mass % and not more than 16 mass % of silicon, not less than 1 mass % and not more than 3 mass % of iron, not less than 1 mass % and not more than 2 mass % of nickel, not less

than 0.5 mass % and not more than 2 mass % in total of one or more selected from the group consisting of titanium, zirconium, chromium and vanadium, not less than 0.6 mass % and not more than 3 mass % of copper, and not less than 0.2 mass % and not more than 2 mass % of magnesium, the balance being essentially aluminum;

subjecting said aluminum alloy powder to cold forming to obtain a preform;

heating said preform to a temperature range of 400 degrees C to 510 degrees C and holding said preform in said temperature range for 5 hours or less;

subjecting said preform to hot plastic working to densify said preform, thereby obtaining a dense body; and

subjecting said dense body to hot plastic working by heating to a temperature not higher than the heating temperature of said preform, thereby manufacturing said aluminum alloy;

the silicon in said aluminum alloy having an average grain diameter of 4 μm or less.

8. The method of claim 6 or 7 wherein the step of subjecting said preform to hot plastic working includes extruding with an extrusion ratio of 6 or more.